DOCUMENT RESUME

ED 172 352 EA 011 739

AUTHOR McKeown, Mary P.
TITLE Distributing State Aid for Pupil Transportation: An Average Cost Formula.
PUB DATE 78
NOTE 53p.; Not available in hard copy due to marginal legibility; Appendices B and D were removed due to illegibility

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Elementary Secondary Education; Expenditure Per Student; *Finance Reform; Mathematical Models; *State Aid; *Student Transportation
IDENTIFIERS Illinois

ABSTRACT

The average cost pupil transportation reimbursement formula developed on the basis of 1976-1977 Illinois pupil transportation data and presented in this paper has several advantages over the current law. This formula would consider the factors that cause variations in the cost of providing the services to Illinois school districts: number and special services required for pupils transported, density of transported pupils, ownership of equipment, and type of school district. The method would be responsive to changes in the economy. It would not be susceptible to district manipulation except in the number of pupils served, since the district's variables would be related to those of other similar districts. The approach accepts current patterns of operation as reasonably efficient, on the average. Finally, the formula encourages efficiency. The only criterion that this type of formula does not meet is that of simplicity. The development of the statistical procedure is initially very complex. However, once the formula is developed, the computer program should not require replication, and state administration would be simple. (Author)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED172352

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Mary McKeown

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

DISTRIBUTING STATE AID FOR PUPIL TRANSPORTATION: AN AVERAGE COST FORMULA

Mary P. McKeown[1]

Purpose

The purpose of this project was to develop a method of distributing state aid for pupil transportation that would recognize variations in average costs, density of pupils transported, types of pupils transported, and types of school district organization. The impact of the developed distribution formula was then simulated and the results analyzed.

Background

School districts have been providing pupil transportation since 1869 when Massachusetts passed the first law allowing the expenditure of public funds for this purpose. By 1919 pupil transportation was provided in all states for some portion of the school population, but state support was very limited until the early 1950s. As late as 1969, six states provided no state funds for pupil transportation. Currently, New Hampshire is the only state that does not provide some support for the operation of pupil transportation programs.[2]

Pupil transportation was first used as the means of providing access to more adequate educational programs for students who lived in rural areas. This busing was a necessary part of the consolidation and reorganization of small school districts into larger attendance centers experienced across the nation during the first half of the 1900s. The basic purpose of this transportation was to ". . . get children to attendance centers expeditiously so that essential instructional needs can be met," and

EA 011 739

transportation was provided between the home and the school only.[3] Gradually, the range of services was broadened to include the use of buses for field trips during the school day and transportation home after extracurricular activities. During the last decade, pupil transportation programs have increasingly been used to achieve racial integration.

Support for these services has been a joint responsibility of state and local governments, and expansion of transportation services contributed to the upward spiral of the cost of these programs. Additionally, inflation, changes in labor practices, and safety standards continue to increase district costs. Pupil transportation has become one of the fastest growing aspects of education during the last fifty years, accounting for 1.8 percent of school expenditures to transport 5.6 percent of the nation's school children in 1920, and for 3.7 percent of school expenditures to transport over 36 percent of the nation's school children in 1972.[4]

Patterns of State Support

Considerable variation is found among the states in the methods used to distribute state aid for support of pupil transportation programs.[5] These range from flat grant programs to foundation programs that equalize aid on the basis of district ability to pay, to formulas that reimburse a specified percentage of district expenditure. Factors on which aid is based also vary greatly and include the number of transported pupils per square mile, expenditures, and assessed valuation.

In six states funding is included in the general state aid program. Nine states use a flat grant distribution formula. Expenditures are the funding criterion in eleven states, and an average cost factor appears to be in use in nineteen states.

The percent of district expenditures provided from state funds ranged in the forty-four states in which aid could be identified from near zero to more than 90 percent; however, over 50 percent of total expenditures was provided in thirty states.

Illinois' Pupil Transportation Aid Program

More than 740,000 pupils, about one-third of the total Illinois school population, were transported during the 1976-1977 school year. Data describing the state's 1976-1977 transportation reimbursement program are shown in Table 1, including the number of eligible pupils transported, the largest district average expenditures per transported pupil, and the state average expenditure per pupil. Of the total district cost of $78,431,000 to transport 681,812 regular and 18,171 vocational pupils, districts were reimbursed 52 percent ($39,750,000) by the state. Special education transportation programs provided services to 44,490 pupils at a total district cost of $40,615,500 of which the state reimbursed districts 71 percent ($28,750,000). Additionally, grants totalling $10.5 million were made by the Illinois Department of Transportation for subsidy of pupil transportation by mass transit systems.

Appendix B provides data for each district or cooperative participating in any of the three transportation programs. The number of pupils transported, the average expenditure per transported pupil, and the ranking of the district's expenditure among other district expenditures are provided. A key to coding of districts is provided in Appendix A.

State aid for pupil transportation is available for regular, special education, and vocational education pupils. Aid for regular pupil transportation is provided through a two-tier formula. Under this program a district receives the greater of (1) a flat grant of $16 per eligible

pupil, or (2) the allowable cost to transport eligible pupils, less the qualifying tax rates times the district's equalized assessed valuation. If this calculation results in the state's paying 80 percent or more of the district's allowable costs, the district must levy a transportation fund tax rate of at least .12 percent to receive any amount in excess of 80 percent. Certain expenditures, such as transportation costs for extracurricular activities or for noneligible pupils, are excluded from consideration for state funding.

Table 1

Summary Transportation Data, 1976-1977

Type of Pupil	Number of Pupils Transported	Largest Average Expenditure	State Average Expenditure
Regular	681,812	$ 600	$111
Special Education	44,490	$8,847	$912
Vocational Education	18,171	$2,527	$149
Total	744,473		

In 1976-1977, 197 districts (19 percent) received aid under the flat grant provision of the formula at a total cost of $870,190, and 586 districts (57 percent) received an amount equal to the cost of their programs less the qualifying amount at a cost of $29,887,000. The remaining 248 districts (24 percent) received aid in excess of 80 percent of costs, constituting a state allotment of $14,779,124.

In addition to transportation of regular pupils, the state has assumed 80 percent of the cost of transporting special education pupils and

vocational education pupils. There is no per pupil dollar limit in these reimbursement programs. In 1976-1977, approximately $28.7 million was provided for transportation of 44,490 special education pupils. In the same year approximately $1.4 million was provided to support transportation of 18,171 vocational education pupils, bringing the total state expenditure for pupil transportation reimbursement programs to approximately $68 million.

Due to energy shortages, inflation, escalating labor costs, and broadened services, transportation costs would have been expected to increase over the last several years. Total cost of these transportation programs for 1976-1977 were over $118 million, up from $114 million in 1975-1976, and up from $59 million in 1970-1971. Table 2 summarizes the changes in total costs for eligible pupils, state aid, and average cost per eligible pupil between 1971 and 1977. Average expenditures per regular pupil increased 54 percent in the period, with state aid increasing 49 percent. The average expenditure per special education pupil increased 155 percent, and state aid for special education transportation increased 142 percent. Average expenditures for vocational pupils transported rose 15 percent, and state aid increased 269 percent during the period. Appendix C gives a frequency table for average expenditure per transported pupil for regular, special education, and vocational transportation programs.

Table 3 shows the total state expenditures for transportation claims, appropriations for 1973-1977, and predicted figures for 1977-1981. Figure 1 presents these numbers graphically. Note that, while the total expenditures for pupil transportation have increased dramatically since 1973, state appropriations have increased at a constant level.

Table 2

Illinois School District Transportation
Expenditures and State Reimbursement, 1971-1977

	Total 1971	Total 1977	Percentage Change	Per Pupil 1971	Per Pupil 1977	Percentage Change
Regular Transportation						
District Expenditures	$43,693,085	$75,430,907	72.63	$71.97	$110.63	53.71
State Reimbursement	$25,295,133	$37,715,450	49.10			
Special Education Transportation						
District Expenditures	$14,480,504	$40,615,500	173.68	$358.27	$912.19	154.60
State Reimbursements	$11,872,403	$28,750,000	142.15			
Vocational Education Transportation						
District Expenditures	$458,131	$2,707,788	491.05	$129.19	$149.02	15.34
State Reimbursement	$366,505	$1,353,895	269.40			

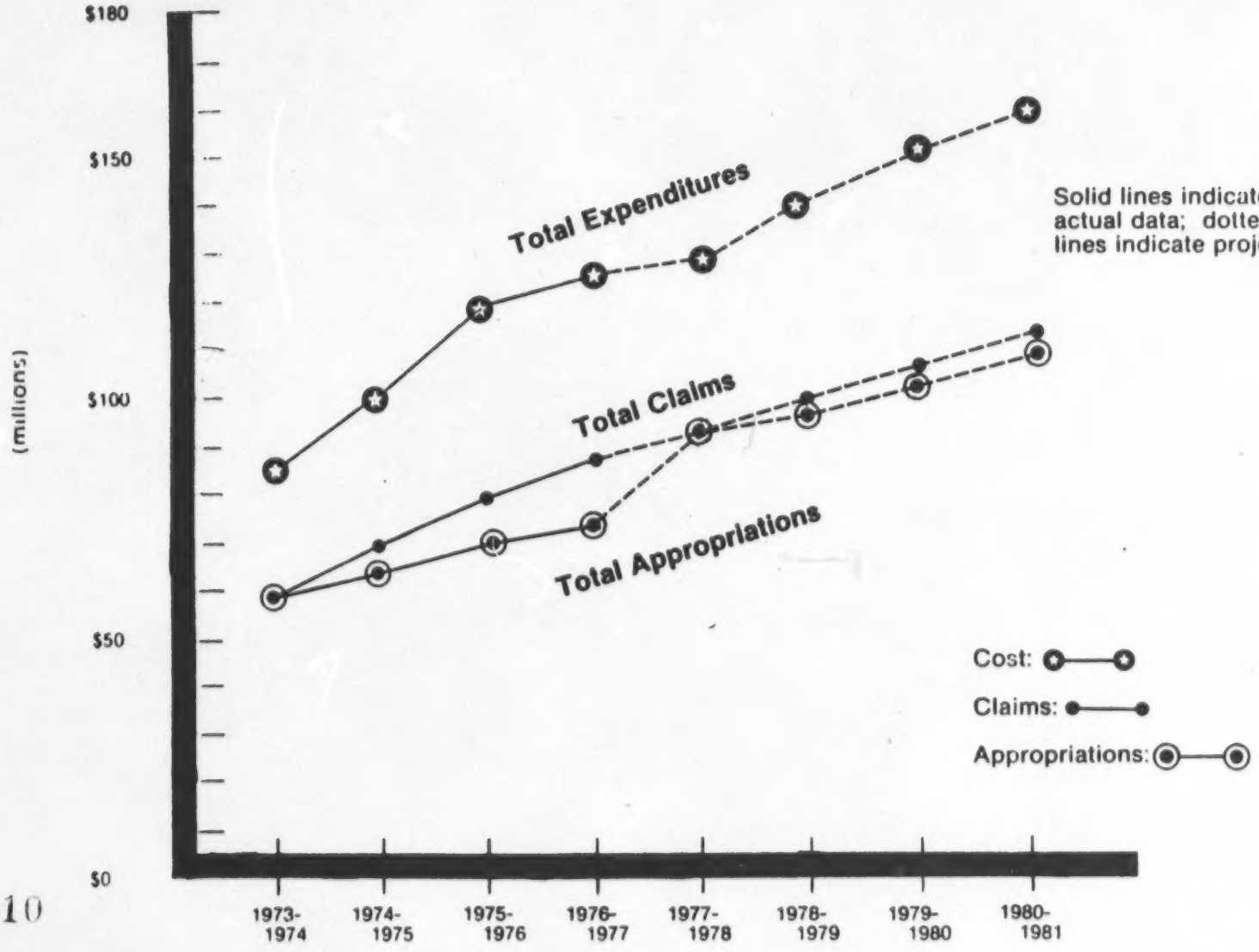
Table 3

Illinois Transportation Expenditures, Claims and State Aid Appropriations

Year	Expenditures	Claims	Appropriations
1973 - 1974	$ 83,246,863	$ 56,162,070	$ 56,162,070
1974 - 1975	98,374,794	68,052,307	59,129,774
1975 - 1976	114,504,236	79,313,072	65,806,140
1976 - 1977	118,754,195	82,369,830	68,500,000
Projected Data*			
1977 - 1978	127,067,000	88,650,000	88,650,000
1978 - 1979	135,961,680	94,855,000	93,969,000
1979 - 1980	145,479,000	101,495,385	99,607,000
1980 - 1981	155,622,525	108,600,005	105,583,000

*Expenditures and claims are predicted for 1978 through 1981 at increases of 7 percent; appropriation projections are based on increases of 6 percent. Figures for 1973 through 1977 are actual dollar amounts.

Figure 1


$180
$150
$100
$50
$0
(millions)
Total Expenditures
Total Claims
Total Appropriations
Solid lines indicate actual data; dotted lines indicate projections.
Cost:
Claims:
Appropriations:
1973-1974
1974-1975
1975-1976
1976-1977
1977-1978
1978-1979
1979-1980
1980-1981

For 930 districts that transported regular pupils, the average percentage of pupils transported was about 50 percent. Forty districts transported 95 percent or more of their pupils by means of transportation, and forty-two districts transported less than 5 percent. The distribution of the percentage of pupils enrolled during the fall of 1976 and transported is shown in Table 4.

Criteria for Evaluating Pupil Transportation Funding Programs

Featherston and Culp outlined several criteria for evaluating state aid programs that are of particular interest when considering the average cost formula.[6] First, the distribution method used should consider the legitimate factors that cause variation in the cost of providing the service. These factors include the density of the transported pupil population, road conditions, and the cost of living in the community in which the program is operated. Density may be measured by number of pupils per square mile of area in the district, by the number of miles travelled per pupil transported, by the number of total bus miles travelled, or by any similar means.

Second, the method should be as simple as possible, but accurate, allowing for variable cost factors. Simple formulas reduce the amount of clerical work necessary at both the local and state levels to determine the amount of aid due each district. Variable costs must be considered to avoid reimbursing one district more to the detriment of others.

Third, whenever possible, the factors should be of such a nature that local school districts cannot manipulate them to increase compensation. Factors beyond a district's control, such as road conditions, density, and cost of living meet the criterion. The number of buses, the number

Table 4

Percent of Pupils Transported by Regular Transportation*

Percentage	Number of Districts
0 - 5 percent	42
5 - 10	18
10 - 15	23
15 - 20	36
20 - 25	32
25 - 30	44
30 - 35	64
35 - 40	49
40 - 45	65
45 - 50	66
50 - 55	64
55 - 60	75
60 - 65	80
65 - 70	57
70 - 75	56
75 - 80	53
80 - 85	31
85 - 90	24
90 - 95	27
over 95	40
Total	946

*The number of pupils is the number reported in Fall Pupil Enrollment and Teacher Statistics, Illinois Public Schools 1976-1977, Illinois Office of Education Circular Series A, Number 366, 1977.

of pupils transported, and the number of miles travelled, may be manipulated by local districts. Obviously, not all of these factors can be eliminated from transportation formulas.

Fourth, allocations should be based on past experience. Despite the fact that many of the programs in existence are inefficient, many are efficient, and, on the average, should provide a guide for establishing efficiency levels.

Fifth, the reimbursement formula for transportation programs should be as objective as possible while still maintaining flexibility to meet the needs of varied school districts. If the objective of a transportation funding method is to eliminate the social, economic, and geographical inequalities which hinder a school district in the transportation of pupils, flexible objectivity is critical.

Finally, methods for determining transportation aid should promote efficiency. Although the aim of transportation aid is to compensate those districts that have the burden of providing transportation, this aid should not reward those districts that are spending this money unwisely or inefficiently.

The Average Cost Formula

As early as 1928 R. L. Johns listed criteria for judging costs of transportation programs.[7] Johns maintained that the state should recognize as legitimate factors in a method of funding those variables beyond the control of communities. He added that the state should base reimbursement upon average costs, but should not encourage inefficiency of operation in the distribution of these funds. Johns went on to develop a formula for funding transportation which was based on the relationship between some independent variable and the percent of ADA transported.

A predictive equation of the form $Y = a + bx$ was developed and plotted on a curve of best fit. This was one of the first efficiency-oriented formula for funding school transportation. Johns used data from four states to determine that the density of the school population was predictive of per pupil transportation costs.

Johns' study was based on the works of Paul Mort and Robert L. Burns, part of a landmark study of pupil transportation and school consolidation done at Teachers College, Columbia University. In 1926 Mort placed school transportation in the minimum foundation funding programs.[8] He suggested the use of density as a factor related to measuring the needs of a community within the foundation program and that density might be a variable beyond the control of a community.

Burns developed a formula of the form $Y = be^{ax}$ for funding transportation, which included the number of pupils transported and the area of the district in the determination of reasonable expenditures for transportation.[9] Burns studied transportation in New Jersey to determine factors predictive of cost and used these factors to develop from a regression equation an index to be used as a measure of need for transportation services. He concluded that the log of the density of a school population was a valid and reliable criterion for predicting transportation needs. He further added that the application of such a formula to state funding of transportation did not demand a knowledge of the statistical theory underlying the derivation of the formula.

Several years later, in a study of transportation in Ohio schools, Clayton Hutchins analyzed factors relating to transportation expenditures.[10] He found that the major factors affecting these costs were the number of

pupils transported, density and road conditions. Tables of values were developed for use in the Ohio state transportation program.

Ward Reeder recommended financial economy in transportation programs. The costs of transportation measured by the cost per bus, cost per pupil, or cost per mile were to be measured to determine a reasonable, or average, cost for transportation funding at the state level.[11]

Butterworth and Ruegsegger summarized the previous studies of transportation costs by observing that density seems to be an adequate measure of transportation need, and is a more reliable measure in a densely populated state than in a sparsely populated one.[12] However, they recommended that more than one factor must be used--including pupil distance, management and economic factors.

After 1941, little was written about pupil transportation until 1965 when Featherston and Culp published their definitive work on pupil transportation. Significant research since 1965 included the work of the National Educational Finance Project with commentaries by Stollar, Frohreich, and others on pupil transportation.[13]

Procedures

Data Source

Data were gathered from the 1974-1975, 1975-1976, and 1976-1977 transportation aid claim files of the Illinois Office of Education. A copy of the form used in 1976-1977 is included as Appendix D. Data from 1975-1976 and 1974-1975 were used only to determine the predictive validity of the developed formula. All districts claiming reimbursement were included in the study.

Definitions

For the purpose of this project, the following definitions were used:

1. Areal density: the number of pupils transported per square mile in the district.

2. Cost to transport regular pupils: total district expenditures reported on line 26 of the Transportation Claim Form.

3. Cost to transport vocational education pupils: total district expenditures reported on Line 21B of the Transportation Claim Form.

4. Cost to transport special education pupils: total district expenditures reported on Line 21C of the Transportation Claim Form.

5. Efficient districts: those districts whose total adjusted reimbursement for transportation costs was predicted to be more than its actual costs. Efficient districts spend less to transport pupils than is predicted.

6. Eligible regular pupils: those students transported to and from school who live a distance of 1½ miles or more from the school as reported on Line 2A of the Transportation Claim Form.

7. Inefficient districts: those districts whose total adjusted reimbursement for transportation costs was less than its actual costs.

8. Least efficient districts: Those districts whose total adjusted reimbursement for transportation costs was less than one-fourth its actual expenditures.

9. Linear density: bus route miles travelled per pupil transported.

10. Mode of Operation: form of ownership: district, contractor, or mixed as reported on Line 12 of the Transportation Claim Form.

11. Type of district: elementary, high, or unit school district.

Development of the Formula

Development of the efficiency-oriented formula for funding transportation required several steps. The first of these was the determination of those factors that accounted for differences in the costs of transporting each regular pupil. Correlations between the cost per regular pupil and several transportation variables were calculated. Correlations were weighted by the total number of eligible pupils transported. After it

was determined that there were no variables strongly interrelated, regressions of the cost to transport each regular pupil were run against different combinations of factors. Dummy variables were introduced to the regression equation for type of district and mode of operation, the only categorical variables. Different combinations of these dummy variables and other cost factors were used in the regression routine until a sufficiently high explanatory power (R^2), which accounted for at least fifty percent of the variance in costs, was obtained.

To consolidate all three transportation aid programs into one predictive equation, weights for special education and vocational pupils were determined. The state average costs to transport each regular, special education, and vocational pupil were calculated based on 1976-1977 data. The ratio between the average cost for vocational pupils and the average cost for regular pupils was used as the weighting for vocational pupils. For special education pupils, the average cost to transport children with certain types of handicaps was calculated. Statewide data on the incidence of handicapping conditions were used to estimate the number of pupils in each cost category in a district. These numbers, multiplied by the percentage incidence, were totalled to get one weighting for special education pupils.

The total number of weighted transportation pupils was determined for each district by adding the number of regular pupils to the number of weighted special education and vocational education pupils. This pupil count was then multiplied by the predicted cost per regular pupil for each district as determined by the regression formula. For districts or cooperatives that did not provide regular transportation, or for

districts for which a predicted cost was impossible to calculate because of unavailable data, the state average cost per pupil was used.

Findings

Formula Development

To determine which factors accounted for differences among districts in the costs of transportation, correlations were calculated among several components of the transportation claim form for 1975-1976. These components were the number of pupils transported, the total bus miles travelled, the area of the district, and the cost to transport eligible pupils, lines 2A, 3A, 10, and 26, respectively, of the claim form. The cost per eligible pupil (Line 26 divided by Line 2a), the cost per bus mile (Line 26 divided by Line 3a), areal density (Line 10 divided by Line 2a), and linear density (Line 3a divided by Line 2a) were also calculated. There was very little interrelationship between the factors except between the cost per bus route mile and the linear density. This was not surprising since these variables are not discrete.

The multiple correlations between the independent variables--linear density and areal density--and the two dependent variables--cost per eligible pupil and cost per bus route mile--were then calculated. Scattergrams were plotted with cost per eligible pupil on the Y axis and linear density and areal density on the X axis. These scattergrams are shown in Figures 2 and 3.

Note that the scattergram showing cost per eligible pupil and linear density (Figure 2) is a good example of an inefficient program. As bus route miles per pupil increased, cost increased in a near-direct proportion. The relationship between the cost per pupil and areal density was curvilinear. As the number of pupils per square mile decreased, cost

Figure 2

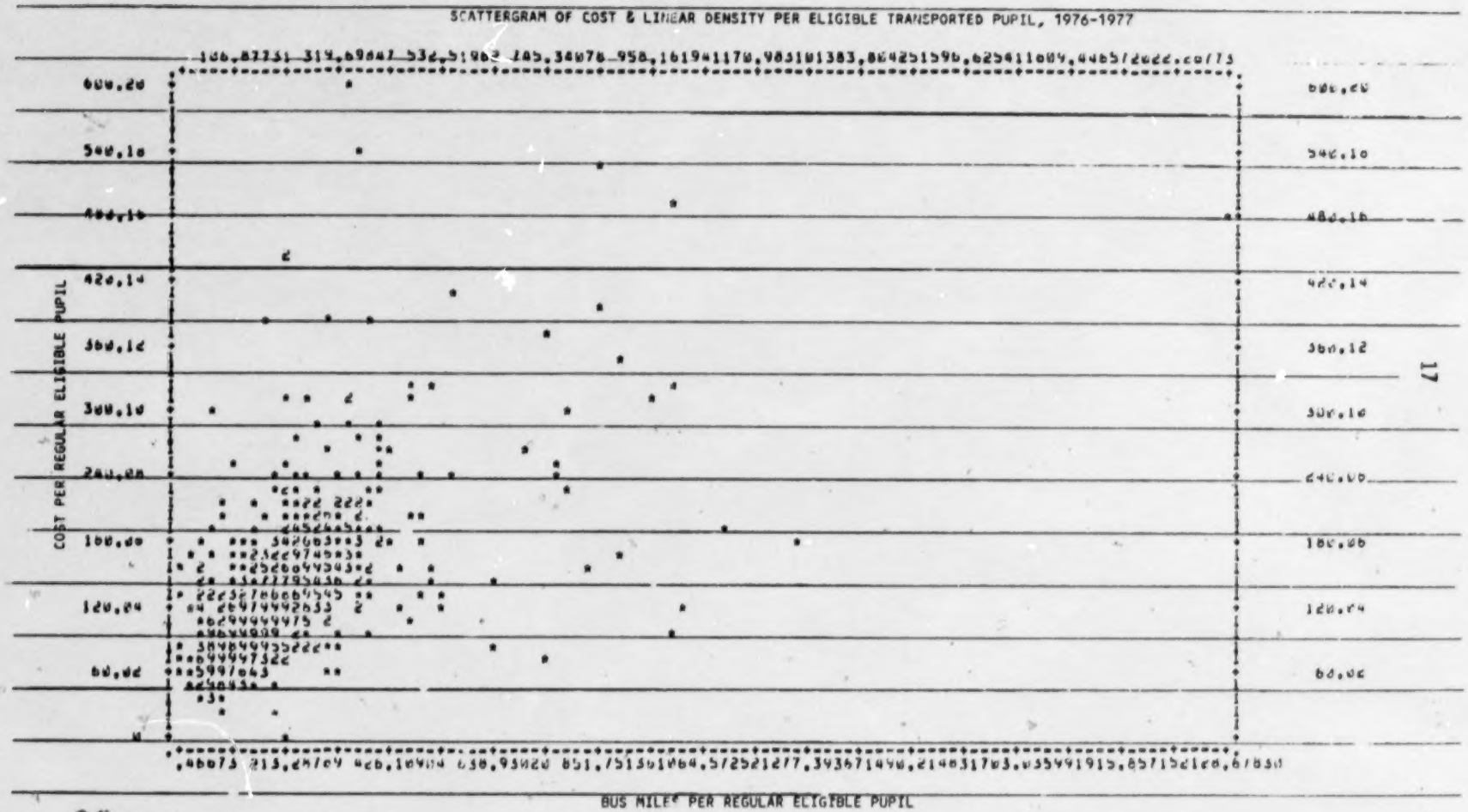
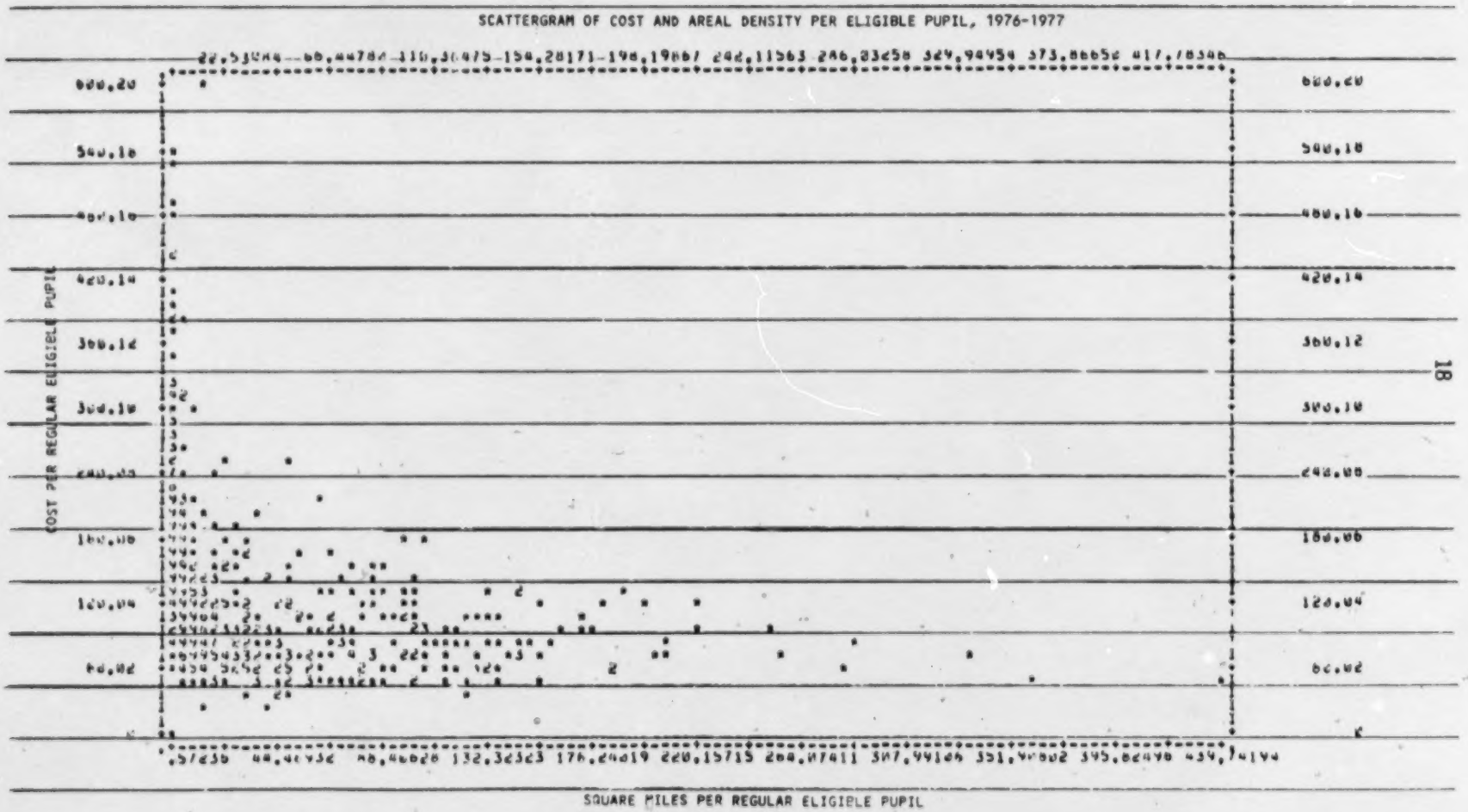

SCATTERGRAM OF COST & LINEAR DENSITY PER ELIGIBLE TRANSPORTED PUPIL, 1976-1977
COST PER REGULAR ELIGIBLE PUPIL
BUS MILES PER REGULAR ELIGIBLE PUPIL

Figure 3


SCATTERGRAM OF COST AND AREAL DENSITY PER ELIGIBLE PUPIL, 1976-1977
COST PER REGULAR ELIGIBLE PUPIL
SQUARE MILES PER REGULAR ELIGIBLE PUPIL

increased. Because the relationships among the dependent variables and the independent variables were curvilinear, correlations of the logs of the variables were calculated. In addition, the independent variables had very skewed distributions. Because a major assumption in the use of correlation computations is that variables are normally distributed, log variables, which are more normally distributed, were utilized.

All previous work using an average cost approach had separated the school districts in a state into groups by density, type of district, or some other factor. Experimental studies done for Illinois using 1974-1975 and 1975-1976 data also separated districts into nine categories based on type of district and method of operation. The largest correlation obtained from work on these data for cost per pupil for all kinds of districts was .5609. Separating the regular transportation programs into groups by district type and mode of operation required that nine separate formulas be generated for the prediction of cost per pupil. This would not be a simple formula for a state agency to administer. Consequently, a formula that consolidated types of district, forms of equipment ownership, and the three types of transportation programs was developed.

Because the multiple correlation between the selected variables and the cost per pupil transported was relatively low (R = .55599), dummy variables were introduced to the predictive equation as surrogates for two variables, type of district and form of ownership. Eight dummy variables were used to account for each form of ownership within type of district. Use of these dummy variables in the log form of the equation produced a multiple correlation of .63794, which accounted for more of the variance (.4070 as compared to .3091) than did the equation

without the use of dummy variables. Use of these dummy variables enabled the inclusion of all districts in one equation since controls for those variables, which differentiated districts, type of district, and mode of operation, were included.

However, this inclusion of these variables did not account for at least 50 percent of the variance. Consequently, additional dummy variables, controlling for type of district and mode of operation within areal density and linear density, were introduced. Use of these variables produced one predictive equation for all districts within the state with a R of .75028 and R^2 of .5252. Variables used in this predictive equation are listed in Table 5. Correlations between the twenty-seven variables are shown in Table 6. Table 7 shows correlations between variables when only eight dummy variables were used. The correlation coefficients and R^2s for the combinations of variables tested are shown in Table 8.

The predictive equation derived by this method is given in Figure 4. Like all regression equations that predict some value for a dependent variable from a combination of independent variables, this equation is data-specific; that is, the regression coefficients so determined are usable only with the data from which the coefficients were calculated.

Inclusion of Special Education and Vocational Transportation Programs

To develop a single formula for all school transportation programs, weights were calculated for vocational and special education pupils. Weights for special education and vocational education pupils were determined by finding the state average cost to transport each regular, special education, and vocational education pupil. Based on 1976-1977 data, these costs were $110.63, $912.91, and $149.02, respectively. The ratio between the average cost for vocational pupils and the average cost for regular pupils was 1.347 ($149.02/$110.63) and was used as the

Table 5

Variables Used to Predict Expenditure Per Pupil

I. Eligible pupils per square mile

- A. In districts that owned and operated transportation equipment
  1. Elementary school districts
  2. High school districts
  3. Unit school districts
- B. In districts that contracted for transportation services
  1. Elementary school districts
  2. High school districts
  3. Unit school districts
- C. In districts that both owned transportation equipment and contracted for transportation services
  1. Elementary school districts
  2. High school districts
  3. Unit school districts

II. Bus route miles per eligible pupil

- A. In districts that owned and operated transportation equipment
  1. Elementary school districts
  2. High school districts
  3. Unit school districts
- B. In districts that contracted for transportation services
  1. Elementary school districts
  2. High school districts
  3. Unit school districts
- C. In districts that both owned transportation equipment and contracted for transportation services
  1. Elementary school districts
  2. High school districts
  3. Unit school districts

III. Type of school district and mode of operation

- A. In districts that owned and operated transportation equipment
  1. Elementary school districts
  2. High school districts
  3. Unit school districts
- B. In districts that contracted for transportation services
  1. Elementary school districts
  2. High school districts
  3. Unit school districts
- C. In districts that both owned transportation equipment and contracted for transportation services
  1. Elementary school districts
  2. High school districts
  3. Unit school districts

Table 6
Correlations of Variables

SAMPLE SIZE = 600

WEIGHTED SAMPLE = 3,630479300

CORRELATION MATRIX

	1 DUMMY 1	2 DUMMY 2	3 DUMMY 3	4 DUMMY 4	5 DUMMY 5	6 DUMMY 6	7 DUMMY 7	8 DUMMY 8	9 SA/CA
1 DUMMY 1	1.000000								
2 DUMMY 2	-0.394601	1.000000							
3 DUMMY 3	-0.329607	-0.359618	1.000000						
4 DUMMY 4	-0.115041	-0.125576	-0.104946	1.000000					
5 DUMMY 5	-0.096049	-0.104821	-0.087582	-0.030514	1.000000				
6 DUMMY 6	-0.204497	-0.223135	-0.186490	-0.064977	-0.054220	1.000000			
7 DUMMY 7	-0.167710	-0.183009	-0.152984	-0.053331	-0.044509	-0.094831	1.000000		
8 DUMMY 8	-0.243267	-0.265393	-0.221840	-0.077328	-0.064529	-0.137538	-0.112753	1.000000	
9 SA/CA	-0.033900	-0.037000	-0.030927	-0.011150	-0.009310	-0.019830	-0.016251	-0.008965	1.000000
10 SA/CA	-0.049384	-0.053898	-0.045048	-0.016244	-0.013557	-0.028877	-0.023673	-0.013057	-0.013053
11 SA/CA	-0.086106	-0.093965	-0.078553	-0.028326	-0.023643	-0.050354	-0.041279	-0.022766	-0.022761
12 SA/CA	-0.053349	-0.058224	-0.048673	-0.017548	-0.014648	-0.031197	-0.025573	-0.014104	-0.014102
13 SA/CA	-0.111260	-0.121424	-0.101504	-0.036592	-0.030541	-0.065041	-0.053327	-0.029410	-0.029404
14 SA/CA	-0.049384	-0.053898	-0.045048	-0.016244	-0.013557	-0.028877	-0.023673	-0.013057	-0.013053
15 SA/CA	-0.247753	-0.270363	-0.226061	-0.081506	-0.068029	-0.144931	-0.118824	-0.065529	-0.065513
16 SA/CA	-0.106717	-0.116459	-0.097369	-0.035109	-0.029296	-0.062402	-0.051166	-0.028213	-0.028205
17 SA/CA	-0.243267	-0.265393	-0.221840	-0.077328	-0.064529	-0.137538	-0.112753	-0.062177	-0.062161
18 SA/CA	-0.053367	-0.058240	-0.048686	-0.017553	-0.014651	-0.031208	-0.025582	-0.014109	-0.014107
19 SA/CA	-0.115049	-0.125570	-0.104974	-0.037850	-0.031582	-0.067291	-0.055161	-0.030419	-0.030411
20 SA/CA	-0.053367	-0.058240	-0.048686	-0.017553	-0.014651	-0.031208	-0.025582	-0.014109	-0.014107
21 SA/CA	-0.247753	-0.270363	-0.226061	-0.081506	-0.068029	-0.144931	-0.118824	-0.065529	-0.065513
22 SA/CA	-0.111260	-0.121424	-0.101504	-0.036592	-0.030541	-0.065041	-0.053327	-0.029410	-0.029404
23 SA/CA	-0.053367	-0.058240	-0.048686	-0.017553	-0.014651	-0.031208	-0.025582	-0.014109	-0.014107
24 SA/CA	-0.115049	-0.125570	-0.104974	-0.037850	-0.031582	-0.067291	-0.055161	-0.030419	-0.030411
25 SA/CA	-0.111260	-0.121424	-0.101504	-0.036592	-0.030541	-0.065041	-0.053327	-0.029410	-0.029404
26 SA/SA	-0.053367	-0.058240	-0.048686	-0.017553	-0.014651	-0.031208	-0.025582	-0.014109	-0.014107
27 SA/SA	-0.053367	-0.058240	-0.048686	-0.017553	-0.014651	-0.031208	-0.025582	-0.014109	-0.014107
28 SA/SA	-0.053367	-0.058240	-0.048686	-0.017553	-0.014651	-0.031208	-0.025582	-0.014109	-0.014107

	10 SA/CA	11 SA/CA	12 SA/CA	13 SA/CA	14 SA/CA	15 SA/CA	16 SA/CA	17 SA/CA	18 CA/18
10 SA/CA	1.000000								
11 SA/CA	-0.044361	1.000000							
12 SA/CA	-0.030853	-0.033101	1.000000						
13 SA/CA	-0.115442	-0.123799	-0.094862	1.000000					
14 SA/CA	-0.044311	-0.047543	-0.036448	-0.053084	1.000000				
15 SA/CA	-0.230013	-0.246699	-0.189144	-0.275550	-0.106078	1.000000			
16 SA/CA	-0.100264	-0.107567	-0.082467	-0.120107	-0.046245	-0.209998	1.000000		
17 SA/CA	-0.225324	-0.241720	-0.185320	-0.269918	-0.103924	-0.471920	-0.205636	1.000000	
18 SA/CA	-0.049873	-0.053497	-0.041013	-0.059735	-0.022998	-0.104434	-0.045509	-0.022151	1.000000
19 SA/CA	-0.106978	-0.114743	-0.087982	-0.128144	-0.049340	-0.224064	-0.097638	-0.047520	-0.021161
20 SA/CA	-0.049873	-0.053497	-0.041013	-0.059735	-0.022998	-0.104434	-0.045509	-0.022151	-0.009866
21 SA/CA	-0.230013	-0.246699	-0.189144	-0.275550	-0.106078	-0.481920	-0.209998	-0.102214	-0.045509
22 SA/CA	-0.103464	-0.110978	-0.085092	-0.123943	-0.047715	-0.216697	-0.094424	-0.045955	-0.020464
23 SA/CA	-0.049873	-0.053497	-0.041013	-0.059735	-0.022998	-0.104434	-0.045509	-0.022151	-0.009866
24 SA/CA	-0.106978	-0.114743	-0.087982	-0.128144	-0.049340	-0.224064	-0.097638	-0.047520	-0.021161
25 SA/CA	-0.103464	-0.110978	-0.085092	-0.123943	-0.047715	-0.216697	-0.094424	-0.045955	-0.020464
26 SA/SA	-0.049873	-0.053497	-0.041013	-0.059735	-0.022998	-0.104434	-0.045509	-0.022151	-0.009866
27 SA/SA	-0.049873	-0.053497	-0.041013	-0.059735	-0.022998	-0.104434	-0.045509	-0.022151	-0.009866
28 SA/SA	-0.049873	-0.053497	-0.041013	-0.059735	-0.022998	-0.104434	-0.045509	-0.022151	-0.009866

	19 CA/18	20 CA/18	21 SA/18	22 CA/18	23 SA/18	24 CA/18	25 CA/18	26 CA/18	27 CA/SA
19 CA/18	1.000000								
20 CA/18	-0.045509	1.000000							
21 CA/18	-0.209998	-0.045509	1.000000						
22 CA/18	-0.094424	-0.020464	-0.092478	1.000000					
23 CA/18	-0.045509	-0.009866	-0.044361	-0.020464	1.000000				
24 CA/18	-0.097638	-0.021161	-0.095193	-0.043930	-0.021161	1.000000			
25 CA/18	-0.094424	-0.020464	-0.092078	-0.042491	-0.020464	-0.043930	1.000000		
26 CA/SA	-0.045509	-0.009866	-0.044361	-0.020464	-0.009866	-0.021161	-0.020464	1.000000	
27 CA/SA	-0.045509	-0.009866	-0.044361	-0.020464	-0.009866	-0.021161	-0.020464	-0.009866	1.000000
28 CA/SA	-0.045509	-0.009866	-0.044361	-0.020464	-0.009866	-0.021161	-0.020464	-0.009866	-0.009866

Table 7

Correlation Matrix, 8 Dummy Variables

	1 Dummy 1	2 Dummy 2	3 Dummy 3	4 Dummy 4	5 Dummy 5	6 Dummy 6	7 Dummy 7	8 Dummy 8	9 3A/2A	10 2A/10	11 26/2A
1 Dummy 1	1.00000										
2 Dummy 2	-0.04201	1.00000									
3 Dummy 3	-0.08267	-0.03416	1.00000								
4 Dummy 4	-0.11801	-0.04876	-0.09594	1.00000							
5 Dummy 5	-0.04406	-0.01821	-0.03582	-0.05114	1.00000						
6 Dummy 6	-0.24967	-0.10315	-0.20298	-0.28977	-0.10820	1.00000					
7 Dummy 7	-0.12778	-0.05280	-0.10389	-0.14831	-0.05538	-0.31376	1.00000				
8 Dummy 8	-0.01453	-0.00600	-0.01181	-0.01686	-0.00630	-0.03568	-0.01826	1.00000			
9 3A/2A	-0.10750	-0.05169	-0.16615	-0.23594	-0.01416	0.21602	0.13784	0.05281	1.00000		
10 2A/10	0.17116	0.01670	0.05170	0.22769	-0.03911	-0.34432	-0.01348	-0.01846	-0.66488	1.00000	
11 26/2A	0.03042	-0.07198	-0.08050	0.03334	0.07272	-0.04594	0.13168	0.04090	0.59196	-0.50248	1.00000

Table 8

Correlations of Cost Per Pupil
with Sets of Independent Variables

Predictive Variables	1975-1976 R	1975-1976 R^2	1976-1977 R	1976-1977 R^2
Areal Density	.3113	.0970	.2946	.0868
Log Areal	.5086	.2586	.5025	.2525
Linear Density	.5336	.2847	.5844	.3415
Log Linear	.4480	.2007	.5920	.3504
Linear & Areal Densities	.5420	.2938	.5851	.3424
Log (Linear & Areal Density)	.5560	.3091	.6096	.3716
Areal Density & 8 dummies	.3989	.1590	.3793	.1439
Log (Areal Densities & 8 Dummies)	.6016	.3618	.5887	.3465
Linear Density & 8 Dummies	.5772	.3330	.6259	.3918
Log (Linear Density & 8 Dummies)	.4975	.2475	.6506	.4233
Linear Density & Areal Density & 8 Dummies	.5915	.3498	.6288	.3955
Log (Linear & Areal Density & 8 Dummies)	.6379	.4070	.6823	.4655
Linear Density & Areal Density in dummies for mode & type	.7368	.5329	.7216	.5207
Log (Linear & Areal Density & 26 Dummies)	.7247	.5252	.7503	.5629

Figure 4

Regression Equation
26 Independent Variables

$$Y = 1.8401 + .094518X_1 - 1.3034X_2 - 1.0784X_3 - .10352X_4 - .52477X_5 - .69399X_6 - 1.4968X_7 + .016364X_8 + .15624X_9 + .10203X_{10} + .69703X_{11} + .56764X_{12} + .16239X_{13} + .34506X_{14} + .42893X_{15} + .81810X_{16} + .13892X_{17} - .13261X_{18} - .065259X_{19} - .008745X_{20} + .061045X_{21} - .015193X_{22} + .051402X_{23} - .066407X_{24} - .04889X_{25} - .090726X_{26}$$

where Y = log of predicted cost per pupil unit

$X_1 = 1$, if the district is an elementary district which contracts; otherwise, $X_1 = 0$.

$X_2 = 1$, if the district is an elementary district which owns and contracts; otherwise, $X_2 = 0$.

$X_3 = 1$, if the district is a high school district which owns; otherwise, $X_3 = 0$.

$X_4 = 1$, if the district is a high school district which contracts; otherwise, $X_4 = 0$.

$X_5 = 1$, if the district is a high school district which owns and contracts; otherwise, $X_5 = 0$.

$X_6 = 1$, if the district is a unit district which owns; otherwise, $X_6 = 0$.

$X_7 = 1$, if the district is a unit district which contracts; otherwise, $X_7 = 0$.

$X_8 = 1$, if the district is a unit district which owns and contracts; otherwise, $X_8 = 0$.

Figure 4 continued

$X_{18} = \log \frac{2a}{10}$, if the district is an elementary district which owns; otherwise, $X_{18} = 0$.

$X_{19} = \log \frac{2a}{10}$, if the district is an elementary district which contracts; otherwise, $X_{19} = 0$.

$X_{20} = \log \frac{2a}{10}$, if the district is an elementary district which owns and contracts; otherwise, $X_{20} = 0$.

$X_{21} = \log \frac{2a}{10}$, if the district is a high school district which owns; otherwise, $X_{21} = 0$.

$X_{22} = \log \frac{2a}{10}$, if the district is a high school district which contracts; otherwise, $X_{22} = 0$.

$X_{23} = \log \frac{2a}{10}$, if the district is a high school district which owns and contracts; otherwise, $X_{23} = 0$.

$X_{24} = \log \frac{2a}{10}$, if the district is a unit district which owns; otherwise, $X_{24} = 0$.

$X_{25} = \log \frac{2a}{10}$, if the district is a unit district which contracts; otherwise, $X_{25} = 0$.

and

$X_{26} = \log \frac{2a}{10}$, if the district is a unit district which owns and contracts; otherwise, $X_{26} = 0$.

26

Figure 4 continued

$X_9 = \log \frac{3a}{2a}$, if the district is an elementary district which owns; otherwise, $X_9 = 0$.

$X_{10} = \log \frac{3a}{2a}$, if the district is an elementary district which contracts; otherwise, $X_{10} = 0$.

$X_{11} = \log \frac{3a}{2a}$, if the district is an elementary district which both owns and contracts; otherwise $X_{11} = 0$.

$X_{12} = \log \frac{3a}{2a}$, if the district is a high school district which owns; otherwise, $X_{12} = 0$.

$X_{13} = \log \frac{3a}{2a}$, if the district is a high school district which contracts; otherwise, $X_{13} = 0$.

$X_{14} = \log \frac{3a}{2a}$, if the district is a high school district which owns and contracts; otherwise, $X_{14} = 0$.

$X_{15} = \log \frac{3a}{2a}$, if the district is a unit district which owns; otherwise, $X_{15} = 0$.

$X_{16} = \log \frac{3a}{2a}$, if the district is a unit district which contracts; otherwise, $X_{16} = 0$.

$X_{17} = \log \frac{3a}{2a}$, if the district is a unit district which owns and contracts; otherwise, $X_{17} = 0$.

27

weighting for vocational pupils. For special education pupils, it was determined that the average cost for transporting pupils with certain severe types of handicaps, such as the physically handicapped, was $2,200, while the average cost of transporting other special education pupils was only $335 per pupil.[14] Pupils with learning disabilities and speech handicaps were considered to be no more expensive to transport than regular pupils. These data were used to develop the following weights for special education pupils transportation:

Learning disabled and speech handicapped (64 percent of handicapped pupils)	0.00
Physically and multiply handicapped (3 percent)	21.00
Others (33 percent)	3.00

The total number of weighted pupils was determined for each district by adding the number of regular pupils to the number of weighted special education and vocational education pupils. Statewide data on the incidence of handicapping conditions were used to estimate the number of high-cost, middle-range and low-cost special education transported pupils in each district.[15]

The predicted cost per regular pupil for each district was next determined by the application of the multiple regression equation. The total number of weighted pupils for each district was then multiplied by the predicted cost per regular pupil for each district. For districts or cooperatives that did not provide regular transportation, or for districts for which a predicted cost was impossible to calculate because of unavailable data, the state average cost per pupil ($110.63) was used. An example of the computation of the predicted cost per pupil, and of the total predicted cost of transportation services for a sample district is given in Appendix E.

Simulation of Reimbursements

For each district in the state that transported regular, vocational, or special education pupils, a total predicted cost was determined using the model described above. Based on the total predicted costs, two simulations of the state allocation using the developed formula were run. In the first simulation, cost to the state was adjusted to the total Fiscal Year 1978 appropriation, $68,500,000, to show the impact of the technique on current reimbursement levels. A second simulation was made using the total budget request for transportation for Fiscal Year 1979, $88,650,000.

Iterative calculations of district allocations were made so that total district costs, that is, the total predicted cost for the state, would equal the funds available from appropriations. If a district's adjusted state aid figure was larger than the district's actual cost, 100 percent of cost was provided from state funds as the district allocation. Using $68,500,000, seventy-eight districts were found to be operating at a level equal to or less than the predicted reimbursement for equivalent districts. When $88,650,000 was distributed, 315 districts were operating below the predicted state aid amount. These districts would receive 100 percent of transportation costs under this program, thus enabling other districts to receive 99.81 percent of their predicted reimbursement per pupil.

Comparison of Distribution of $68,500,000 under Current Law to Distribution Under the Efficiency-Formula

Although distribution of the amount of state aid for transportation in the simulation was the same as the amount distributed for 1976-1977, the distribution of this aid among districts was very different. No district received the same amount in the simulation as it did in 1976-

1977. Five hundred and one districts would have had total reimbursement increased, while 515 would have had aid decreased. Two hundred and two, or 19.9 percent, of the 1,016 districts would have had aid changes of less than 10 percent; 51 percent, or 518 districts, would have changes of less than 30 percent. Changes are summarized in Table 9. There was no pattern to the type of district in which the increase was in excess of 100 percent. These districts were in all geographical areas and represented all three types of districts and all three types of ownership.

On the other hand, districts that would have lost more than 60 percent tended to be elementary districts whose equalized assessed valuations per pupil were near or above the state average. This might indicate that these districts not only spent more than the state average per pupil (i.e., have high local aspiration levels), but also spent much more per pupil than predicted for districts of similar type, density, and form of ownership. Additionally, fifteen of the nineteen elementary districts in this group, and twenty-two of the twenty-five total districts included in this group transported less than 100 pupils. Seventeen of the twenty-five districts transported less than 50 pupils. Because the reduction in the reimbursement for transportation costs was so large for these districts, while other districts of similar density that transported more pupils did not lose aid, it might be concluded that there are certain economies of scale present. All districts that transported less than 75 pupils would have received less from the state under this formula than they currently receive.

Districts that would have lost more than 60 percent of their 1976-1977 reimbursement under the distribution of $68,500,000 transported from 0 to 91 percent of their pupils by regular transportation. Eleven of these

Table 9

Distribution of $68,500,000 under the Average Cost Formula
Compared to Distribution of $68,500,000 under Current Law

Percentage Change	Number of Districts	
	Increases	Decreases
0 - 10	80	102
10 - 20	75	111
20 - 30	63	92
30 - 40	48	82
40 - 50	47	69
50 - 60	44	32
60 - 70	29	15
70 - 80	23	10
80 - 90	18	2
90 - 100	18	
100 - 200	45	
200 - 300	7	
300 - 400	1	
over 400	3	
Total	501	515

twenty-seven districts transported only special education students. The fact that there is a disproportionate number of districts that transported only special education pupils among the districts that would lose more than 60 percent of their claim amounts, gives additional evidence to the charge that the current distribution method rewards inefficiency. Districts that transport only special education pupils are assured that they will receive at least a prorated 80 percent of whatever they spend for this transportation with no limit to what is spent. Consequently, there is no inducement to cut, or hold the line on, expenditures. Such districts may benefit under a distribution that includes the actual distribution of special education children instead of the estimate used in the simulations. It is interesting to note that districts that transported regular pupils as well as special education pupils did not lose as much under this formula.

Comparison of Distribution of $88,650,000 by the Efficiency Formula to the Current Program

Because distribution of $88,650,000 under the efficiency formula would distribute $20,000,000 more than is currently being distributed, it would be expected that almost all districts that transported pupils would gain. This was not the case. Eight hundred and two districts would have had total reimbursement increased while 214 would have had aid decreased. Of the 1,016 districts, 121 or 11.9 percent would have had aid changes of less than 10 percent; 36.8 percent, or 374 districts, would have changes of less than 30 percent. This is summarized in Table 10. As expected, more districts gained and had larger percentage increases when $88,650,000 was distributed than when $68,500,000 was distributed.

Table 10

Distribution of $88,650,000 under the Average Cost Formula
Compared to Distribution of $68,500,000 under Current Law

Percentage Change	Number of Districts	
	Increases	Decreases
0 - 10	64	57
10 - 20	77	63
20 - 30	74	39
30 - 40	80	26
40 - 50	73	15
50 - 60	99	5
60 - 70	80	6
70 - 80	64	2
80 - 90	43	1
90 - 100	28	
100 - 200	102	
200 - 300	13	
300 - 400	2	
over 400	3	
Total	802	214

As in the distribution of $68,500,000, there was little pattern to the type of district in which the gain was in excess of 100 percent. These 121 districts came from all geographical areas, represented all types of districts and all types of ownership. Note that over 10 percent of the total 1,016 districts in the state would gain more than 100 percent. On the other hand, eight of the nine districts that would have lost more than 60 percent were elementary districts that contracted for transportation services. All nine transported fewer than fifty pupils. These districts transported from 6 to 84 percent of the pupils enrolled in the fall of 1976.

Efficient Districts. For the purpose of this analysis, an efficient district was defined as a school district whose total predicted reimbursement for transportation costs was more than its actual costs. Efficient districts spent less to transport pupils than the formula predicted for districts of similar density, type, and form of ownership.

When $68,500,000 was distributed, seventy-eight districts were found to be efficient districts. These districts were operating at a level of spending for transportation less than or equal to the predicted aid for equivalent districts. A phone survey was made among a random sample of these efficient districts to determine if there were characteristics of efficient districts that differentiated them from districts that did not operate at an efficient level. In addition to the phone survey, other characteristics studies included form of ownership, size of district, equalized assessed valuation per pupil, income per pupil, type of district, and geographic location.

Efficient districts were located in all parts of the state, employed all forms of ownership, and represented all types of districts. They

transported from 153 to 5,500 pupils, and had wealth ranging from one-fifth of the state's average wealth per pupil to two times the state's average wealth. Approximately one-third employed full-time transportation directors or bus maintenance personnel. Only two used computerized bus routing. Their only common characteristic was that all used staggered school hours or used multiple bus routes. However, this may be a characteristic of inefficient, as well as efficient, districts. Thus, it was not possible to define characteristics that distinguished the efficient districts.

These efficient districts transported from 0 to 93 percent of their pupils under the regular transportation program. The distribution of percentages of pupils transported by regular means for these efficient districts was similar to the total distribution of percentages of pupils transported. Likewise, the average percentage transported under the regular transportation program among the "efficient" districts was about 51 percent, approximately equal to the state average percentage transported of 50 percent.

When $88,650,000 was distributed, 315 districts were found to be operating at a level equal to or less than the predicted reimbursement for equivalent districts. Efficient districts again were located in all parts of the state, employed all forms of ownership, and represented all types of districts. These districts transported from 0 to 95 percent of their pupils under the regular transportation program, and had an average percentage of enrolled pupils transported of 50 percent, equal to the average percentage of enrolled pupils transported for the state as a whole.

Inefficient Districts. For purposes of this paper, an inefficient district was defined as a school district whose total predicted reimbursement for transportation expenditures was less than its actual cost. Least efficient districts were defined as those districts whose total adjusted reimbursement for transportation expenditures was less than 25 percent of actual expenditures. The least efficient districts spent at least four times more for transportation than the efficiency model predicted for districts of similar density, type, and form of ownership. When $68,500,000 was distributed, twenty-four districts were categorized as least efficient.

A phone survey was made of these least efficient districts to determine if there were characteristics that differentiated the least efficient districts from districts that operated at efficient levels. Characteristics studied included form of ownership, type of district, size of district, equalized assessed valuation per pupil, income per pupil, geographic location, and percent of pupils transported.

Least efficient districts were located in all parts of the state, but, in contrast to efficient districts, twenty of the twenty-four least efficient districts contracted for transportation services. Eighteen were elementary districts, five were high school districts, and one was a unit district. Eight transported only special education pupils while twenty-one transported fewer than 75 pupils. These districts had wealth ranging from one-fifth of the state's average wealth to five times the state's average wealth. None employed full-time transportation directors or bus maintenance personnel, and only one utilized staggered school hours or multiple bus routing. However, these latter characteristics may be a function of the size of these districts.

A composite description of districts that were least efficient would include the following facts: It is a small, elementary district that contracts for transportation services. Of its 200 pupils, less than seventy-five are transported at an average cost of more than three times the state average cost for transportation of regular pupils. This district does not use staggered school hours nor multiple bus routes, since it has only one school.

There are several paths such a school district could follow to become more efficient. Because transportation of less than 75 pupils is a characteristic of the least efficient districts, such districts might find that the formation of a transportation cooperative of districts in the same area that would transport more than seventy-five pupils, would reduce the per pupil cost. Similarly, the merging of several districts into one unit district would accomplish the same objective, but require a more radical change in organizational structures. Such districts might also utilize staggered school starting hours and multiple bus routing to reduce costs, if the size of the district could warrant such an activity.

Conclusion

The average cost pupil transportation reimbursement formula developed on the basis of 1976-1977 Illinois pupil transportation data and presented in this paper has several advantages over the current law when evaluated using the criteria outlined earlier. This formula would consider the factors that cause variations in the cost of providing the services to Illinois school districts: number and special services required for pupils transported, density of transported pupils, ownership of equipment and type of school district. The method would be responsive to

changes in the economy. It would not be susceptible to district manipulation except in the number of pupils served since the district's variables would be related to those of other similar districts. The approach accepts current patterns of operation as reasonably efficient, on the average. Finally, the formula encourages efficiency.

The only criterion that this type of formula does not meet is that of simplicity. The development of the statistical procedure is initially very complex; however, once the formula is developed, the computer program should not require replication, and this should reduce the level of difficulty. District data used are already collected; however, they are not currently subject to audit. If used in a distribution formula, a variable should be verified by audit. Once the statistical formula was developed, state administration would be simple.

Notes

[1]Dr. Mary P. McKeown is a school finance specialist with the Illinois State Aid Equalization Study, which is funded by the U.S. Office of Education under Section 842 of Public Law 93-380.

[2]See Dewey E. Stollar, "Pupil Transportation," in R. L. Johns, Kern Alexander, and K. Forbis Jordan, Planning to Finance Education (Gainesville, Florida: National Educational Finance Project, 1971), Page 330; and K. Forbis Jordan and Carol E. Hanes, "A Survey of State Pupil Transportation Programs," School Business Affairs (May 1978), pages 133-136.

[3]Ernest Farmer, Pupil Transportation: The Essentials of Program Service (Danville, Illinois: Interstate Printers, 1975), page 59.

[4]Stollar, pages 333-334.

[5]Jordan and Hanes, page 134.

[6]Glen Featherston and D. P. Culp, Pupil Transportation: State and Local Programs (New York: Harper and Row, 1965), page 15.

[7]R. L. Johns, State and Local Administration of School Transportation (New York: Teachers College, Columbia University, 1928), pages 14-15.

[8]Paul R. Mort, The Measurement of Educational Need: A Basis for Distributing State Aid, Contributions to Education Number 150 (New York: Teachers College, Columbia University, 1926), page 61.

[9]Robert L. Burns, Measure of the Need for Transportation Pupils, Contributions to Education Number 289 (New York: Teachers College, Columbia University, 1927), pages 17-19.

[10]Clayton D. Hutchins, "The Distribution of State Funds for Pupil Transportation," Doctoral dissertation (Columbus, Ohio: Ohio State University, 1938).

[11]Ward G. Reeder, The Administration of Pupil Transportation (Columbus, Ohio: The Educators' Press, 1939), pages 151 and 155.

[12]Julian E. Butterworth and V. Ruegsegger, Administering Pupil Transportation (Philadelphia: Educational Publishers, Inc., 1941), pages 115-125.

[13]See for example, Dewey E. Stollar, "Pupil Transportation," pages 329-360; and Lloyd E. Frohreich, "Pupil Transportation Programs" in Kern Alexander and K. Forbis Jordan (ed), Financing the Public Schools of South Dakota (Gainesville, Florida: National Educational Finance Project, 1973), pages 181-215.

[14]These weights are similar to those established by J. Cousins for Cincinnatti. His research found an average cost of $875 per special education pupil, comprised of $2,500 per high cost pupil and $330 per low cost pupil.

[15]Since district by district incidence data were unavailable, data on statewide incidence levels obtained from the 1977 census of handicapped children formed in compliance with Public Law 94-142.

Appendix A

Key to the Coding of Counties by Region

Region	County		Region	County	
01	001	Adams	44	052	Lee
02	002	Alexander	45	053	Livingston
03	003	Bond	46	054	Logan
04	004	Boone	47	055	Macon
05	005	Brown	48	056	Macoupin
06	006	Bureau	49	057	Madison
07	007	Calhoun	50	058	Marion
08	008	Carroll	51	059	Marshall
05	009	Cass	52	060	Mason
09	010	Champaign	36	061	Massac
10	011	Christian	53	062	McDonough
11	012	Clark	54	063	McHenry
12	013	Clay	55	064	McLean
13	014	Clinton	46	065	Menard
11	015	Coles	56	066	Mercer
14	016	Cook	57	067	Monroe
15	017	Crawford	58	068	Montgomery
11	018	Cumberland	59	069	Morgan
16	019	DeKalb	11	070	Moultrie
17	020	DeWitt	60	071	Ogle
18	021	Douglas	61	072	Peoria
19	022	DuPage	62	073	Perry
20	023	Edgar	18	074	Piatt
21	024	Edwards	63	075	Pike
22	025	Effingham	26	076	Pope
03	026	Fayette	02	077	Pulaski
23	027	Ford	51	078	Putnam
24	028	Franklin	64	079	Randolph
25	029	Fulton	12	080	Richland
26	030	Gallatin	65	081	Rock Island
27	031	Greene	66	082	St. Clair
28	032	Grundy	26	083	Saline
29	033	Hamilton	67	084	Sangamon
30	034	Hancock	05	085	Schuyler
26	035	Hardin	59	086	Scott
31	036	Henderson	68	087	Shelby
32	037	Henry	32	088	Stark
33	038	Iroquois	69	089	Stephenson
34	039	Jackson	70	090	Tazewell
12	040	Jasper	71	091	Union
29	041	Jefferson	72	092	Vermilion
07	042	Jersey	21	093	Wabash
35	043	Jo Daviess	31	094	Warren
36	044	Johnson	13	095	Washington
37	045	Kane	73	096	Wayne
38	046	Kankakee	74	097	White
39	047	Kendall	75	098	Whiteside
40	048	Knox	76	099	Will
41	049	Lake	77	100	Williamson
42	050	LaSalle	04	101	Winnebago
43	051	Lawrence	78	102	Woodford
			80	105	Dept. of Corrections

Appendix C-2

Frequency Count for Special Education Transportation Average Cost Per Pupil

Range	Number of Districts
$ 0.00 - 25.00	4
25.01 - 50.00	2
50.01 - 75.00	2
75.01 - 100.00	3
100.01 - 125.00	5
125.01 - 150.00	8
150.01 - 175.00	8
175.01 - 200.00	11
200.01 - 225.00	17
225.01 - 250.00	12
250.01 - 275.00	13
275.01 - 300.00	12
300.01 - 325.00	19
325.01 - 350.00	21
350.01 - 375.00	10
375.01 - 400.00	14
400.01 - 425.00	9
425.01 - 450.00	11
450.01 - 475.00	15
475.01 - 500.00	25
500.01 - 525.00	15
525.01 - 550.00	25
550.01 - 575.00	19
575.01 - 600.00	18
600.01 - 625.00	19
625.01 - 650.00	21
650.01 - 675.00	21
675.01 - 700.00	22
700.01 - 725.00	30
725.01 - 750.00	32
750.01 - 775.00	30
775.01 - 800.00	31
800.01 - 825.00	25
825.01 - 850.00	25
850.01 - 875.00	19
875.01 - 900.00	15
900.01 - 925.00	23
925.01 - 950.00	27
950.01 - 975.00	14
975.01 - 1,000.00	16
1,000.01 - 1,025.00	14
1,025.01 - 1,050.00	17
1,050.01 - 1,075.00	11
1,075.01 - 1,100.00	4
1,100.01 - 1,125.00	8
1,125.01 - 1,150.00	8
1,150.01 - 1,175.00	6
1,175.01 - 1,200.00	6
1,200.01 - 1,225.00	8
1,225.01 - 1,250.00	3
1,250.01 - 1,275.00	8
1,275.01 - 1,300.00	6
1,300.01 - 1,325.00	7
1,325.01 - 1,350.00	8
1,350.01 - 1,375.00	11
1,375.01 - 1,400.00	3
1,400.01 - 1,425.00	7
1,425.01 - 1,450.00	6
1,450.01 - 1,475.00	3
1,475.01 - 1,500.00	7
1,500.01 - 1,525.00	2
1,525.01 - 1,550.00	4
1,550.01 - 1,575.00	5
1,575.01 - 1,600.00	7

Range	Number of Districts
$1,600.00 - 1,625.00	4
1,625.01 - 1,650.00	3
1,650.01 - 1,675.00	4
1,675.01 - 1,700.00	2
1,700.01 - 1,725.00	3
1,725.01 - 1,750.00	2
1,750.01 - 1,775.00	3
1,775.01 - 1,800.00	3
1,800.01 - 1,825.00	4
1,825.01 - 1,850.00	3
1,850.01 - 1,875.00	4
1,875.01 - 1,900.00	4
1,900.01 - 1,925.00	
1,925.01 - 1,950.00	1
1,950.01 - 1,975.00	3
1,975.01 - 2,000.00	2
2,000.01 - 2,050.00	2
2,050.01 - 2,100.00	5
2,100.01 - 2,150.00	2
2,150.01 - 2,200.00	1
2,200.01 - 2,250.00	2
2,250.01 - 2,300.00	2
2,300.01 - 2,350.00	4
2,350.01 - 2,400.00	3
2,400.01 - 2,500.00	2
2,500.01 - 2,550.00	2
2,550.01 - 2,600.00	3
2,600.01 - 2,700.00	1
2,700.01 - 2,800.00	5
2,900.01 - 3,000.00	3
3,000.01 - 3,100.00	1
3,100.01 - 3,200.00	2
3,200.01 - 3,300.00	2
3,300.01 - 3,400.00	1
3,500.01 - 3,600.00	1
4,500.01 - 4,600.00	2
4,600.01 - 4,700.00	1
8,700.01 - 8,800.00	1
8,800.01 - 8,900.00	1

Appendix C-1

Frequency Count for Regular Transportation Average Cost Per Pupil

Range	Number of Districts
$ 0.00 - 25.00	1
25.01 - 50.00	12
50.01 - 75.00	95
75.01 - 100.00	165
100.01 - 125.00	195
125.01 - 150.00	164
150.01 - 175.00	124
175.01 - 200.00	76
200.01 - 225.00	34
225.01 - 250.00	24
250.01 - 275.00	9
275.01 - 200.00	6
300.01 - 325.00	8
325.01 - 350.00	3
350.01 - 375.00	1
375.01 - 400.00	4
400.01 - 425.00	2
425.01 - 450.00	1
450.01 - 475.00	1
475.01 - 500.00	1
500.01 - 525.00	1
525.01 - 550.00	2
550.01 - 575.00	0
575.01 - 600.00	0
600.01 - 625.00	1

Appendix C-3

Frequency Count for Vocational Transportation Average Cost Per Pupil

Range	Name of District
$ 0.00 - 25.00	10
25.01 - 50.00	18
50.01 - 75.00	19
75.01 - 100.00	23
100.01 - 125.00	23
125.01 - 150.00	26
150.01 - 175.00	31
175.01 - 200.00	25
200.01 - 225.00	21
225.01 - 250.00	19
250.01 - 275.00	12
275.01 - 300.00	7
300.01 - 325.00	9
325.01 - 350.00	9
350.01 - 375.00	8
375.01 - 400.00	10
400.01 - 425.00	5
425.01 - 450.00	8
450.01 - 475.00	6
475.01 - 500.00	3
500.01 - 525.00	3
525.01 - 550.00	1
550.01 - 575.00	4
575.01 - 600.00	4
600.01 - 625.00	2
625.01 - 650.00	5
650.01 - 675.00	3
675.01 - 700.00	3
700.01 - 725.00	1
725.01 - 750.00	1
750.01 - 775.00	3
775.01 - 800.00	2
800.01 - 825.00	0
825.01 - 850.00	0
850.01 - 875.00	1
875.01 - 900.00	1
900.01 - 925.00	1
925.01 - 950.00	0
950.01 - 975.00	1
975.01 - 1,000.00	0
1,000.01 - 1,100.00	2
1,100.01 - 1,200.00	2
1,200.01 - 1,300.00	1
1,300.01 - 1,400.00	4
1,400.01 - 1,500.00	1
1,500.01 - 1,600.00	1
1,600.01 - 1,700.00	1
-	
-	
2,000.01 - 2,100.00	2
-	
2,500.01 - 2.600.00	1

Appendix E

Sample Computation of Predicted Cost Per Pupil

District Z is a unit district that owns and operates its own transportation equipment. The following information was taken from District Z's 1976-1977 transportation claim form. The numbers in parentheses refer to lines on the transportation claim form.

	Type of Transportation		
	Regular	Special Education	Vocational
Number of pupils transported	465.07 (2a)	19.00 (8)	9.00 (9)
Allowable costs	$45,010.95 (26)	$5,151.95	$1,900.00
Reimbursement under current formula	$21,844.82	$3,638.38	$1,192.43
Allowable cost per pupil	$96.78 $\left[\frac{26}{2a}\right]$	$271.16	$211.11
Miles to and from school	86,924 (3a)		
Area of district	76.00 square miles (10)		

Variables were calculated as follows:

$$\left[\frac{3a}{2a}\right] = \frac{86,924}{465.07} = 186.9051, \log = 1.27162, \text{ and}$$

$$\left[\frac{2a}{10}\right] = \frac{465.07}{76.00} = 6.1193, \log = 0.78670.$$

From the regression equation, the predicted expenditure per pupil would then be equal to the following:

$$Y = 1.8401 - 0.69399 + 0.42893\ (1.27162) - 0.066407\ (0.78670).$$

$$= 1.8401 - 0.69399 + 0.97436 - 0.05224$$

$$= 2.06823$$

This predicted expenditure is in the log form; therefore, the antilog of Y was taken to yield the predicted expenditure per pupil of $117.0119 or $117.01.

The number of weighted transportation pupils in the district was calculated as follows:

Weighted vocational pupils	(9 times 1.347)	12.123
Weighted special education pupils	(19 times 4.294)	81.586
Regular pupils		465.070
Total weighted transportation pupils		558.778

Total predicted expenditures for the district would then be the number of total pupils times the predicted expenditure per pupil (558.778 times $117.01), equal to $65,382.61. Since this amount is in excess of the district's total allowable expenditures of $52,016.90, the district would receive 100 percent reimbursement of this latter amount.